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A METHOD FOR PREVENTING INSECT INJURY TO MATERIAL USED FOR POSTS, POLES, AND RUSTIC CONSTRUCTION

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Introduction

For the last 10 years the Division of Forest Insect Investigations has experimented with the injection of chemicals into the sap stream of living trees in an endeavor to find cheaper methods for the control of bark beetles and for the prevention of insect injury to sound wood.

The principle of injection is not new. Although during the period 1838-40 Boucherie (Memoire sur la Conservation des Bois. Ann. Chim. et Phys. 74: 113-157, 1840) developed a method for injecting living trees with wood preservatives ,he soon gave it up, principally because of difficulties encountered in technique and because the chemical could not be confined to the main stem, in which he was primarily interested. His main contribution concerns the perfection of a method for treating green poles, and for this achievement the French Government signally honored him.

Frederick Moll (Die Imprägnierung des Holzes. Chemische Apparatur 2(4): 49-53, 1915) points out that the fundamental system of the Boucherie method dates back to earlier investigations with regard to the rise of sap in plants and especially in trees. Such research was undertaken by Magnol as early as 1709, by Hales in 1730, and by others.

The present investigations were developed independently of Boucherie's work. This oversight of that author's initial experiments may be largely attributed to his having abandoned, at such an early date, efforts to impregnate living trees with wood preservatives; also to the fact that comparatively little work has been done in this field by other investigators since then. Although numerous patents on methods of treating standing trees have been issued to various inventors since the time of Boucherie, most of these methods are even more complicated or less effective than the process used by him.

The results obtained from treating green trees for use as posts, poles, sills, or rough construction in contact with the ground, and rustic work for furniture, cabins, arbors, and bridges, have been so satisfactory that a preliminary announcement can be made so that the method may be tested by others. We would appreciate information as to contemplated tests and, where possible, we will offer direct assistance through our field personnel.

Results

Service tests with a number of chemicals indicate that, after 6 years in the ground, posts and poles of treated material are still in a perfect state of preservation, showing no insect injury or decay, and with material used in the construction of rustic work the bark on the poles not in contact with the ground is still so tight and sound that it is difficult to remove. Chemical analyses of cross sections of this treated material show that the sapwood is impregnated with the salts of metals, such as copper sulphate or zinc chloride, in concentrations ranging from 1/2 to 1½ pounds per cubic foot.

Methods

The green standing trees can be treated by any one of several methods that involve the complete severance of the conducting tissue of the stem and the use of the living top, namely, stepping, banding, capping, and applying a collar. In all of these methods the crown is left intact during treatment. Although ordinarily the solution will be entirely absorbed by the tree within from 4 to 12 hours, it usually takes about 2 weeks before distribution throughout the entire sapwood is complete; wilting may occur prior to this time.

Stepping Method

The simplest method is "stepping." The tree is cut off at the ground, being kept in a nearly vertical position by lodging the top in the crown of an adjacent tree. It is then lifted, and the butt is set in a container holding the preservative solution.

Banding Method

Another method, suitable for trees larger than those that can be readily lifted and set in a container, is known as the "banding" or the "sawkerf-and-rubber-band" method. (See attached illustration, fig. 2.) The procedure is as follows:

1. At a height convenient for work near the base of the tree the bark is carefully removed in a band about 1 foot wide (fig. 2, a), care being taken not to cut into the sapwood, thus making a smooth, clean surface which permits a water-tight application.

2. The next step consists of sawing a spiral groove or sawkerf (b) within the bark-stripped band, completely around the tree, with the ends of the groove overlapping about 2 inches, and one end being at least 2 or 3 inches above the other. The depth of the cut can vary from several annual layers of wood to the entire depth of the sapwood. For shortleaf pine trees up to 8 inches in diameter, a groove 1 inch deep is sufficient. Too deep a groove allows the tree to sway excessively, permitting leaks to develop or the tree to blow over.

3. With a quarter-inch bit a hole is bored from the upper end of the spiral groove outward through the wood, coming out about 2 inches beyond the end of the cut. Into this hole the end (h) of a rubber tube (g), connecting with the container (e) holding the preservative (f), is inserted and pulled through into the saw-kerf. It is important to remove all of the sawdust and chips from the groove and the bore hole before placing the rubber band about the tree.

4. One end of a special heavy rubber band [1] (j) is fastened with a heavy wire staple [2] (i) over one end of the spiral notch; the band is stretched completely around the tree, care being taken to keep the center of the band over the groove throughout its length. The band is stapled again just beyond the other end of the sawkerf. A foot of the band when stretched will cover from $1\frac{1}{2}$ to $1\frac{3}{4}$ feet of the circumference of the tree. In order to avoid leaks it is sometimes necessary to coat lightly the inside of the band with a thin layer of axle grease and (where there are deep irregularities on the surface of the wood) to use additional staples.

5. At a convenient distance above the girdle (a few inches to a foot) a container (e) holding the wood-preservative solution is hung on the tree. This material is siphoned into the notch by the rubber tubing (g). The container can be held in place by means of a nail (d) or by a cord.

In general, when pines are impregnated by the banding method it is best to complete the treatment in one operation to avoid the possibilities of an accumulation of resin in the sawed groove. This is especially true when treating such species as shortleaf, loblolly, slash, longleaf, and probably ponderosa pine. Interference by pitch accumulation can be minimized by cutting a so-called pitch-girdle (c), i.e., a hack or sawkerf girdle, through the bark and outer layers of wood just above the ground line (k) approximately 24 hours before the trees are to be treated. In the stepping and in the capping methods pitch is a less serious problem than in the sawkerf method. Thoroughness of operation, however, is essential for successful results. After the technique is understood, it is possible for one man to treat a 10-inch tree in 12 minutes. This, of course, is exclusive of the time necessary for the preparation of the solution.

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[1] Specifications for rubber band: The particular type of band found to be most effective to date is made from stock which is $1\frac{3}{4}$ inches wide, $\frac{1}{4}$ inch thick in the center, and 9/16 inch thick on the outer margins. It possesses a hardness of 38-40 durometer (as read by a Type A Shore durometer) and has a tensile strength of 2,500 pounds per square inch. In addition it has an elongation of 650 percent before it will break. Such a band has been furnished by one of the rubber companies which has been cooperating with the Bureau in developing a material suitable for this type of work.

[2] A suitable staple, having a spread of $2\frac{1}{2}$ inches and a leg length of $1\frac{3}{4}$ inches, is made from no. 9 wire. More recently at our Morristown laboratory a short iron bar and two nails have been used in place of staples; each end of the bar has an open slot to permit easy removal and reuse of the rubber band.

Capping Method

A third method, "capping", is suitable for treating small trees (up to 8 inches DBH) which are so situated in the stand as to make it impossible to lodge them readily, as would be necessary for the stepping method. It consists of felling the tree, removing the terminal foot of bark from the butt, taking care to smooth the wood surface, and then stretching one end of a cut automobile inner tube over the end of the trunk for a distance of 3 to 4 inches. If the joint is not tight, a wire tourniquet will aid in holding the tube firmly in place against the surface of the wood. In the case of trees having an irregular trunk, it may be necessary to shape the butt with a drawknife or axe prior to putting the inner tube in place.

When a water-tight connection has been made, the inner tube is filled with the preservative solution and the free end of the tube is attached to a support.

Collar Method

A collar of tin, heavy paper, or rubber, tacked around the tree bole or trunk immediately below the saw notch, has been utilized to a considerable extent in treating bark beetle infested white pines at the Bureau laboratory at Coeur d'Alene, Idaho. The procedure is similar to the banding method except that the saw groove (fig. 1, b) is cut horizontally around the tree and not spirally. A tin or paper collar (m) which previously has been shaped to fit around the stem of trees of a particular diameter, and the lower edges and ends of which have been treated with heavy grease to make the connection waterproof, is tacked (l) around the trunk (a) immediately below the saw notch (b). The two ends of the collar (n), or pieces of collar if several are used, can be either tacked against the trunk of the tree or greased and clamped into a waterproof S-shaped mechanical joint. A collar of rubber, cut from an inner tube or a rubberized cloth, also works very satisfactorily. In this case a narrow band of tin is tacked to the lower edge of the collar as it is being fastened to the tree; the upper edge of the rubber also must be tacked to the tree at several places to form a pocket. Such collars form containers for the chemical in solution (f) and eliminate the use of the siphon, copper tubing, and separate container. If a metal collar is used with a corrosive solution, the inner surface must be heavily coated with a waterproof material, such as grease, asphalt, or black paint, to avoid corrosion and possible loss of solution through leakage.

Other Methods

In developing the technique here recommended a number of other methods have been tried, such as auger holes and various kinds of plastic and banding materials. None of these have proved very reliable or practical. No doubt new and more simplified methods will occur to those who attempt the use of this technique for treating green timber. Suggestions of more simplified procedure will be appreciated.

Solutions

For the present we are suggesting that the treatments be restricted to a few chemicals, principally aqueous solutions of salts of metals, such as zinc chloride and copper sulphate.

The most suitable concentrations have been found to consist of three-fourths pound of copper sulphate (crystals) or of zinc chloride per one-half gallon of water for each cubic foot of sapwood in the tree stem. If the tree contains no heartwood, the entire volume of the stem is considered for treatment. In larger trees with a narrow band of sapwood the dosage is estimated on the basis of the cubic contents of the sapwood cylinder. The heartwood cannot be treated satisfactorily. In table 1 the dosages required in any instance can be determined readily by referring to the size of the tree in question. By noting the diameter (in inches) and the height (in feet) of a particular tree, the quantity of chemical and of water necessary is easily found by reading from the left and down from the top of the table to the intersecting space. This arrangement eliminates the necessity of computing the volume of any tree. With more toxic poisons, such as mercury bichloride, solutions of less concentration give equally satisfactory results. Chemicals that are highly corrosive to metal (as mercury bichloride and copper sulphate) should not be injected if nails or metal fixtures are to be employed in the final utilization of the treated material.

Species Capable of Treatment

Our experimental work has been based on tests with a limited number of tree species, principally pine, spruce, fir, oak, hickory, and yellow poplar. It is quite likely that many species can be treated effectively by these methods.

Time of Year for Treatment

Green, healthy conifers can be injected with chemical solutions successfully at any time of the year. During cold weather, however, the solutions are subject to freezing, and in such cases final distribution will not result until the chemical thaws and is completely taken up by the tree. Absorption of the chemical is much more rapid during the growing seasons than during the dormant period.

Hardwoods of the species tested were found to take up the chemical solution and to distribute it thoroughly only during the active growing seasons, commencing when the leaf buds begin to swell. Absorption at other times is very slow and distribution is irregular.

Materials Needed and Costs

Trees up to 8 or 12 inches DBH can be treated very quickly and cheaply by these methods. They are simple and can be readily utilized by farmers or farm laborers, the work being done at odd times. Very small material, such as bean poles and small fence posts, can be treated equally well. Species of wood that otherwise would be readily destroyed when in contact with the ground can be utilized to advantage.

If the stepping method is used, the only equipment necessary is a few containers, each capable of holding the butt of a tree and from 2 to 3 gallons of solution. These can be used repeatedly. Where a corrosive solution is selected, such as copper sulphate, noncorrosive containers (wood, enamel, or heavy painted metal) should be used in making the treatments.

The sawkerf method requires an axe, a saw, brace and bit, special rubber banding material, staples, rubber tubing, and suitable containers. All but the staples can be used repeatedly. The rubber bands must be used on successively smaller trees. Excluding the cost of labor, one 5-inch tree, 37 feet high, containing approximately 2 cubic feet of wood, can be treated with copper sulphate at a cost of between 10 and 20 cents, depending on the concentration desired.

Where the capping method is used, the equipment necessary consists of an axe, a saw, an old inner tube, possibly wire and pliers, and cord.

To treat by the collar method it is necessary to have on hand tin, stiff paper, old inner tubes or rubberized cloth for bands, tinner's shears, heavy cup grease or paint and brush, tacks, saw, hammer, and axe.

Table 1.--Recommended dosages (in pounds of chemical 1/ and gallons of water) to use for medicating shortleaf pines of various height and diameter classes.

DBH 2/ in inches	Height of tree in feet															
	20		30		40		50		60		70		80		90	
	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.
3			½	¼	¾	½	1	½	1	½						
4	½	¼	1	½	1¼	½	1½	½	1¾	¾	2	1				
5	¾	½	1½	½	1¾	¾	2	1	2¼	1	2½	1¼				
6			2	1	2¼	1	2½	1¼	2¾	1¼	3	1½	3¼	1½		
7			2½	1¼	2¾	1¼	3¼	1½	3½	1½	3¾	1¾	4	2		
8					3¼	1½	3¾	1¾	4¼	2	4½	2¼	4¾	2¼		
9							4½	2¼	4¾	2¼	5¼	2½	5½	2½	6	3
10							5¼	2½	5½	2½	6	3	6½	3	7	3
11							6	3	6½	3	7	3	7½	3¼	8	3¾
12							6¾	3	7¼	3¼	7¾	3½	8¼	3¾	9	4

1/ A list of companies handling these chemicals will be furnished upon request, as a matter of convenience in localities where they are not readily obtainable.

2/ Diameter breast high.

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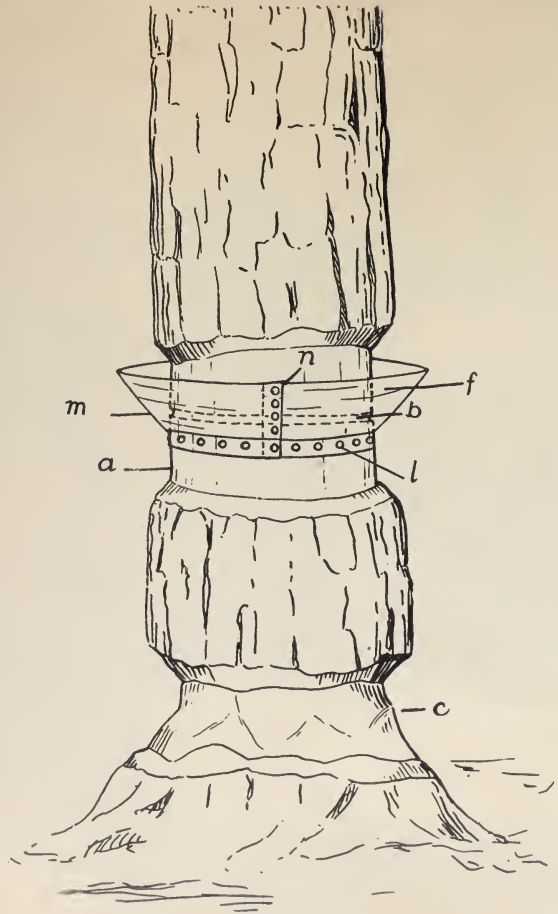

Fig. 1

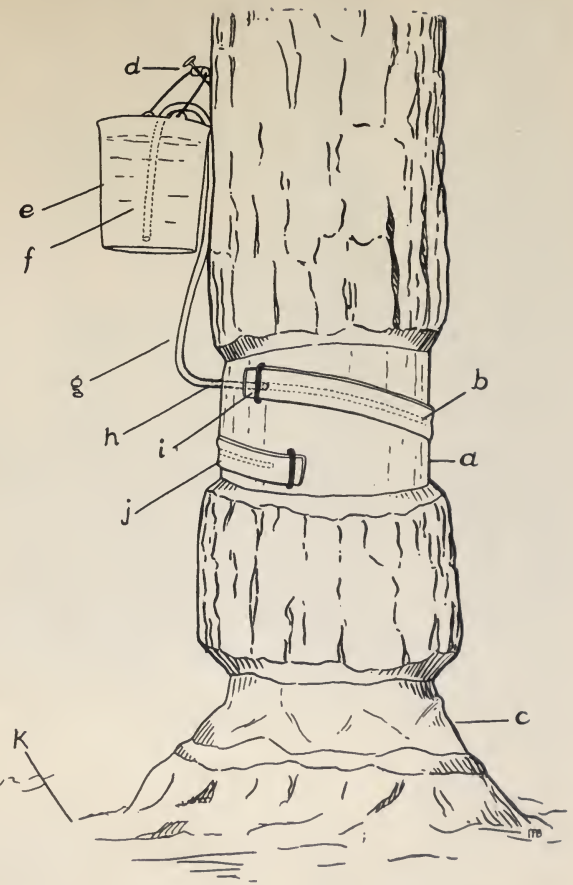

Fig. 2

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